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10/585,875	08/11/2006	Shigeru Ogino	128651	7715

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EXAMINER	
ENIN-OKUT, EDU E	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/585,875	OGINO ET AL.	
	Examiner	Art Unit	
	Edu E. Enin-Okut	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 May 2007 and 03 October 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 October 2008* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/11/06*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

FUEL CELL SYSTEM AND METHOD FOR CONTROLLING THE SAME

Priority

1. Acknowledgment is made of Applicant's claim for foreign priority to Japan Patent Application No. 2004-043421, filed on February 19, 2004, under 35 U.S.C. 119(a)-(d). A certified copy of that application has been received.

Claim Objections

2. Claim 11 is objected to because of the following informalities: The claim recites "... which is a proportion of the reformed oxygen quantity 0 ...". It appears that this phrase should be -- which is a proportion of the reformed oxygen quantity **O** --. Appropriate correction is required.

Claim Analysis

3. Regarding claims 1-11, the claims recite the word "means for" or "step for" in an apparent attempt recite a claim element as a means for (or step for) performing a specified function. These claims must be analyzed using the 3-prong-test to determine if 35 U.S.C. 112, 6th paragraph has been invoked. See MPEP 2181 (I).

The claims pass the first and second prongs of the test. However, the portions of the claims that recite "step for" fail the third prong of the test because the phrase "step for" is modified by sufficient structure, material, or acts for achieving the specified function.

Therefore, the means-plus-function language reciting "means for" in these claims satisfy the 3-prong test and will be treated under 35 U.S.C. 112, 6th paragraph. Applicant discloses that a "fuel quantity detecting means", and a "supplied cathode gas quantity detecting means", is a flow meter on p. 28 of the instant specification. The "power quantity detecting means" is disclosed as a power meter or an ammeter on pp. 27-28 of the instant specification.

The means-plus-function language reciting "step for" in these claims do not satisfy the 3-prong test and will not be treated under 35 U.S.C. 112, 6th paragraph.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 2-8 and 10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claims 2-8 and 10, claims 2 and 10 recite "... a quantity of water generated in the cathode flow channel obtained by the generation in the fuel cell ...". In claims 1 and 9, the "cathode flow channel" is that "which a cathode gas containing oxygen is supplied". It is unclear how water can be generated prior to entry, and subsequent reaction within, the fuel cell. (Claims 3-8 are dependant upon claim 2.)

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sederquist (US 4,128,700) in view of Yamashita et al. (US 2002/0031450). Additional supporting evidence provided by Merriam-Webster's Online Dictionary.

Regarding claim 11, it is noted that the court have held that, to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not to amount to the mere claiming of a use of a particular structure. *Ex parte Pfeiffer*, 135 USPQ 31 (BPAI 1961).

Sederquist teaches a fuel cell power plant including a fuel cell stack and a fuel conditioning apparatus composed of a reactor, which can be integrated with a burner and a heat exchanger, and a shift converter (Abstract; 2:66-3:4, 4:32-34; Fig. 1). Each fuel cell is composed of a cathode electrode spaced from an anode electrode with an electrolyte retaining matrix (3:6-8). The burner receives fuel cell anode and cathode exhaust and, after heating the gases, provides a portion of these gases (the burner exhaust) to the reactor (3:30-41, 3:51-52, 3:59-60, 4:14-15). Fuel for the reactor is added to the burner exhaust and converted to hydrogen (Abstract; 4:15-17). Reformer exhaust has carbon monoxide removed in the shift converter and the resulting gas stream is delivered to a pump that feeds the fuel to the anode side of the fuel cell (4:26-31). A compressor provides air to the cathode side of the cell (3:30-31).

Sederquist does not expressly teach a cathode pump; or, a detecting means for supplied fuel quantity, supplied cathode gas quantity, and generated power quantity; or, a control device for controlling delivery of reform-subject fuel; or, the method steps as recited in the claim.

As to a cathode pump, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a pump to supply cathode gas through the cathode flow channel on the fuel cell system of Sederquist because the use of pump as a means to move reactants to (and from) a fuel cell system is well-known in the art; and, Sederquist teaches that the system is not required to be pressurized (see Sederquist, 4:60-61).

As to the supplied fuel and supplied cathode gas detecting means, it would have been obvious to one of ordinary skill in the art at the time of the invention to include flow meters into the fuel cell system of Sederquist to measure the amount of fuel or cathode gas supplied to the system because the use of these meters are well-known to those skilled in the art as means with which to accomplish this task.

As to the control device and method steps, Yamashita teaches a control device that suitably heats reformate fuel, provided by a reformer to a fuel cell, so as to obtain high-quality reformate gas by stabilizing the temperature of a reforming portion regardless of load fluctuations (Abstract; para. 31). The reformer is composed of a heating portion, a reforming portion, and a carbon monoxide (CO) oxidizing portion (para. 31). The heating portion heats and vaporizes a reformate fuel with use of a combustion portion, such as a burner fed fuel and an oxidizing agent (e.g. air), and a vaporizing portion employing the heat generated by the combustion portion (para. 32, 39). The amount of reformate gas generated in the reformer (i.e., the amount of vapor mixture of reformate fuel generated in the heating portion) corresponds to the load applied to the fuel cell (para. 47, 48).

A control system receives detection signals from a air/fuel (A/F) ratio sensor (disposed at an end of the exhaust pipe of the heating portion); temperature sensors (detects the temperature from combustion

of the reformate fuel and oxidizer); and, a current sensor (detects the load placed on the fuel cell), which are inputted to its electronic control unit (para. 40, 41, 43).

The system determines the amount of reformate fuel needed to produce the hydrogen required by the fuel cell to meet the requirements of the detected load (para. 48). Then, the amounts of combustion fuel and oxidizer required to turn the reformate fuel into the needed reformate gas (i.e., the reforming reaction requirement), and an optimum (or target) air-fuel ratio (based on the temperature of the reforming reaction requirement), are determined (para. 71, 72, 73). In order to maintain the desired reaction temperature, which corresponds to a target air-fuel ratio, the amount of air or fuel provided to the combustion portion of the reformer's heating portion can be adjusted (para. 83-86).

Thus, it would have been obvious to use the control method described by Yamashita to control the fuel cell system of Sederquist, and include a control device in the system in order to perform the method steps, because Yamashita teaches that the method, employing the use of control device, allows the system to adjust the amounts of fuel and cathode gas provided to the fuel cell system in response to changes in load. Further, it would have been obvious to that skilled artisan to employ an ammeter as the current sensor used in the fuel cell system of Sederquist, as modified by Yamashita, because an ammeter known as an instrument for measuring electric current (see "ammeter" on Merriam-Webster's Online Dictionary).

9. Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sederquist in view of Yamashita et al. and Merritt et al. (US 5,441,821).

Regarding claim 1, it has been held that, to be entitled to weight in method claims, the recited structure limitations therein must affect the method in a manipulative sense, and not to amount to the mere claiming of a use of a particular structure. *Ex parte Pfeiffer*, 135 USPQ 31 (BPAI 1961).

Regarding claims 1 and 9, the fuel cell system of Sederquist, as modified by Yamashita, teaches a system that adjusts the delivery of fuel and cathode gas to the system based upon the system's load requirements, as discussed above. However, Sederquist and Yamashita do not expressly teach the determination of a residual oxygen quantity in the cathode offgas as recited in the claim.

Merritt teaches that, characterizing fuel cell systems employing re-circulated reactant streams, it is convenient to define the term "recirculation ratio" as the amount of a reactant supplied to the fuel cell stack divided by the amount of the reactant consumed in one pass through the fuel cell stack (3:27-29). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to calculate the residual oxygen quantity in cathode offgas of fuel cell system of Sederquist, as modified by Yamashita, by subtracting the amount of oxygen consumed by a pass through the fuel cell from that supplied to the cell because Merritt teaches that characteristics of reactants re-circulated in the system can be determined comparing the amount of a reactant introduced to the cell and to that consumed by it; and, a skill artisan would appreciate that subtracting these two values produces the amount of reactant not consumed to the system (and re-circulated back to it).

The remaining limitations recited in these claims have been addressed above with respect to claim 11.

10. Claims 2-8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sederquist, Yamashita et al. and Merritt et al. as applied to claims 1 and 9 above, and further in view of Aoyama (JP 2000-195534 A; refer to JPO Abstract and machine translation).

Regarding claims 2 and 10, Yamashita teaches that the ratio of S/C (steam to carbon) is set to a desired value (e.g., about 2) (para. 48). However, Sederquist, Yamashita, and Merritt do not expressly teach a reformed water quantity calculation step.

Aoyama teaches a fuel cell system with a reforming part producing fuel gas used in a power-generating fuel cell (Abstract). Water discharged from the fuel cell is used to generate steam sent into, and used by, the reforming part (Abstract; machine translation, para. 17,24). If the amount of water produced by the fuel cell is insufficient to provide the steam required by the reforming part, a steam generation part will provide the additional steam needed (machine translation, para. 18). A control part 40 controls the amount of steam provided to the reforming part (machine translation, Claim 2, para. 26,38).

It would have been obvious to one of ordinary skill in the art at the time of the invention include a reformed water quantity calculation step in the method of Sederquist, as modified by Yamashita and Merritt, because Aoyama teaches that a its use is a means with which to control the amount of steam provided to a reformer that used water generated by fuel cell operations.

Further, one would appreciate that the S/C of the fuel cell system of Sederquist, as modified by Yamashita, Merritt and Aoyama, is maintained in target range because Yamashita teaches that this ratio is set when determining the amount of reformate fuel needed to meet the requirements of detected load (see Yamashita, para. 48 and discussed above).

Regarding claim 3, as discussed above, Yamashita teaches that the system determines the amount of reformate fuel needed to produce the hydrogen required by the fuel cell to meet the requirements of the detected load (para. 48). Then, the amounts of combustion fuel and oxidizer required to turn the reformate fuel into the needed reformate gas (i.e., the reforming reaction requirement), and an optimum (or target) air-fuel ratio (based on the temperature of the reforming reaction requirement), are determined (para. 71, 72, 73). In order to maintain the desired reaction temperature, which corresponds to a target air-fuel ratio, the amount of air or fuel provided to the combustion portion of the reformer's heating portion can be adjusted (para. 83-86).

Regarding claim 4, the limitations recited in this claim has been addressed above in claims 1-3.

Regarding claim 5, Sederquist teaches a fuel cell power plant including a fuel cell stack and a fuel conditioning apparatus composed of a reactor, which can be integrated with a burner and a heat exchanger, and a shift converter (Abstract; 2:66-3:4, 4:32-34; Figs. 1, 2), as discussed above.

Further, as discussed above, Yamashita teaches that, in order to maintain the desired reaction temperature, which corresponds to a target air-fuel ratio, the amount of air (oxidizer) or fuel provided to the combustion portion of the reformer's heating portion can be adjusted. One of ordinary skill in the art would readily appreciate that controlling the amount of oxidizer supplied to reformer used in the method of Sederquist, as modified by Yamashita and Merritt, can either suppress, or increase, a burning reaction used to heat the reformer as required by the requirements as determined by the optimum (or target) air-fuel ratio.

Regarding claims 6, 7 and 8, the limitations recited in these claims have been addressed above with respect to claims 1-5.

Conclusion

11. The following prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Ikeda et al. (JP 10-144335 A) teaches a fuel cell where the load of a fuel cell is measured by a load detecting means, a S/C (steam/carbon) ratio is determined by a S/C ratio determining means based on the measured load, and the supply amounts of steam and a raw material gas to be supplied to a reformer of a fuel cell are controlled by supply amount controlling means (e.g., valves) based on the determined S/C ratio (Abstract).

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Edu E. Enin-Okut** whose telephone number is **571-270-3075**. The examiner can normally be reached on Monday to Thursday, 7 a.m. - 3 p.m. (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dah-Wei Yuan can be reached on 571-272-1295. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Edu E. Enin-Okut/
Examiner, Art Unit 1795

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